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Cleaner and greener livestock production: Appraising producers' perceptions regarding renewable energy in Iran

Elham Bozorgparvar, Masoud Yazdanpanah*, Masoumeh Forouzani, Bahman Khosravipour

Khuzestan Agricultural Sciences and Natural Resources University, Mollasani, Ahvaz, Iran

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ABSTRACT

This paper aims to use a comprehensive modeling framework to investigate the intention of Iranian livestock producers to deploy renewable energies on their farms to mitigate climate change. A survey was conducted in southern Iran using a random sample of farmers (n = 140). Structural equation modeling showed that attitude, moral norm, subjective norm, and perceived behavioral control are significant predictors of farmers' intention to use renewable energies. Attitude was determined by positive affect and perceived benefits, and moral norm was determined by perceived benefits, perceived cost, and outcome efficacy. The findings not only have public policy implications for promoting the use of renewable energies by farmers in Iran, but also contribute to the literature on environmental psychology, renewable energy, and pro-environmental behavior in a non-Western country.

1. Introduction

Agriculture is not just vulnerable to Climate change (CC), but also plays a role in producing GHG emissions and driving climate shifts (Jørgensen and Termansen, 2016; Zobeidi et al., 2016; Mousazadeh et al., 2009a). According to Reynolds and Wenzlau (2012), agricultural is the third-largest contributor to GHG emissions. The agricultural sector emits between 14 and 30% of GHG emissions worldwide, mainly from equipment and inputs (see also, Lombardi et al., 2017; Johnson et al., 2007; Arbuckle et al., 2013; Mousazadeh et al., 2009b) like livestock production and breeding. In this regard, Lombardi et al. (2017) have stated that at farm level, the GHG emission is mainly due to the livestock rearing (manure, urine and ruminant digestion). Massé et al. (2011) reported that livestock production contributes to 18% of global GHG emissions through methane (CH4) directly emitted from domestic animals or livestock manures, and nitrous oxide (N2O) emitted from land-applied manures and grazed lands (see also, Massey and Ulmer, 2010). These livestock-sector problems (see Massé et al., 2011) put livestock-raising areas under pressure (see, Steinfeld et al., 2006; Janzen, 2011). Steinfeld et al. (2006, Executive Summary) have argued that, "The livestock sector emerges as one of the top two or three most significant contributors to the most serious environmental problems." Expectations are growing for the livestock production industry to transition toward cleaner and more environmentally friendly practices (Massé et al., 2011). There is also an urgent need for the agriculture and livestock sector to adopt mitigation policies and to follow a green production path (e.g., Arbuckle et al., 2013).

A wide range of solutions, introduced into the agricultural sector to decrease GHG emissions, focus mainly on reducing reliance on fossil fuels. The use of renewable energies (RE) is an important initiative: using RE in livestock farming is an important aspect of CC mitigation policy for agriculture; it is important to note that use of alternative energy sources in agriculture is not just limited to reducing GHG emissions, but has a range of applications. Most studies suggest a lack of community acceptance as a major barrier to the use of alternative energy sources (Huijts et al., 2012). Public resistance to RE can hinder mitigation policy setting and implementation, thus increasing the impact of CC. It is therefore critical to understand how public perceptions of green energy are shaped and why people support or disagree with such initiatives. This understanding will yield major insights for policymakers in terms of more successful design and communication of innovations of this type (Huijts et al., 2012); in-depth knowledge of the mechanisms that steer public opinion to support alternative energy

* Corresponding author.
E-mail address: yazdanm@ramin.ac.ir (M. Yazdanpanah).

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sources is thus crucial. Despite the importance of such research, very little work has been undertaken in this domain, particularly in Iran. The aim of this paper is thus to investigate the intention of Iranian livestock producers regarding the use of RE on their farms as a CC mitigation action. The question of social acceptance of RE in Iran has been under-researched until now. Data of this kind could further inform the development of public policy measures and, it is hoped, increase RE adoption among Iranian farmers.

To understand behavior, social psychologists have evolved a variety of models called expectancy–value models. These models are used in a wide range of areas to investigate behavior; some are used particularly to predict green behavior. Our study was inspired by the suggestion of Huijts et al. (2012) in their seminal work regarding acceptance of new energy technologies. Our study used a more comprehensive model than theirs, that drew mostly upon the core elements of the Theory of Planned Behavior (TPB), the norm activation model (NAM), and other key psychological aspects. Huijts et al. (2012) argued that if the main psychological factors impacting the acceptance of innovation are understood, as well as how those factors link to each other, this can support modification of the innovation plans, communication with the public, and implementation of the innovation. The paper is organized as follows. Section 2 outlines the main components of the theoretical framework and discusses the modifications made for the case study application which is discussed in section 3. Section 4 presents the results and Section 5 discusses the impactions for the increase use of RE by Iranian farmers.

2. Theoretical framework

The theoretical framework comprises three layers (Fig. 1). The last (third) layer is output or acceptance of new technology (in this study, willingness to adopt RE), which is directly affected by the variables on the second layer. The second layer has four constructs, namely, attitude, subjective norm (SN), perceived behavior control (PBC), and moral norm (MN) which are directly affected by the variables on the first layer. The first layer has seven variables, namely, positive affect (PA), negative affect (NA), perceived cost (PC), perceived benefits (PB), perceived risk (PR), problem perception (PP), and outcome efficacy (OE) that influence variables on the second layer (attitude and MN) and have an indirect effect on the third layer (willingness to adopt RE). In the following, we will briefly describe the variables on each layer. The intention in the third layer is the last variable in our framework and refers to an individual's willingness to perform a specific action (Fishbein and Ajzen, 1975).

The first layer consists of a set of variables that directly impact on a variable in the second layer and have an indirect effect on intention in the third layer. In the first layer, attitude is determined by i) PA and NA; ii) PC and PB; and iii) PR. MN is also determined by PC and PB, PR, PP, and OE (see Huijts et al., 2012). In other words, some of these variables specifically affect attitude (PA and NA), some just influence MN (PP and OE); and the rest (PC, PB, and PR) have an effect on both attitude and MN. We explain these briefly in the following.

PB refers to an advantage or profit gained from people engaging in a special behavior or from their perception of the effectiveness of an action. Here, PB refers to farmers' belief in the perceived effectiveness of RE. Thus, higher PB are likely to lead to a superior attitude and the MN to RE. Huijts et al. (2012) have argued that the benefits of renewable energy include personal and collective benefits. PC is another predictor of attitude and MN (directly) and intention (indirectly). Individuals are always concerned about cost of new technology, and this variable could significantly reduce the rate of new technology adoption (Kim et al., 2014; Park and Ohm, 2014). PC is divided into monetary and non-monetary cost. While

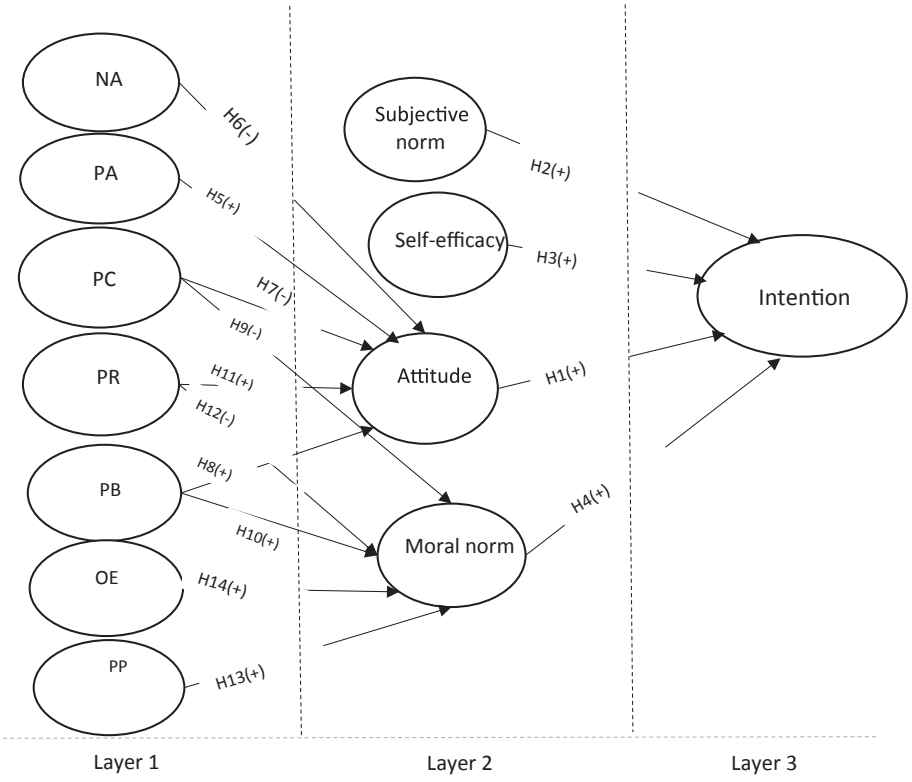

Fig. 1. Conceptual framework.

monetary cost includes the cost of purchasing or using the technology or subsidies, non-monetary cost is related to other factors such as the effort required for understanding or learning about the new technology (see Huijts et al., 2012). Moreover, PR could also predict attitude and MN. Risk refers to a subjective estimation of the nature of a threat and its severity (Sjoberg, 1998). It is a mental construct (Sjoberg, 2000) and completely dependent on individual minds and culture (Slovic, 1992). The acceptance of any kind of innovation or technology carries with it some degree of risk: different kinds of risk, for example, safety and financial risk (see Huijts et al., 2012). Some researchers (Bamberg et al., 2007; Kaiser et al., 2008; Harth et al., 2013; Onwezen et al., 2014) have argued that emotion is one of the factors that could be at play in people's reactions to environmental challenges and might also guide pro-environmental intentions. In other words, emotion can encourage people to choose environmentally friendly behavior in order to feel good about themselves (Onwezen, 2015). This can refer to individual's feelings for a person, object, or event (Frijda, 1986; cited in Onwezen, 2015). Emotion can be split into PA and NA as two distinct constructs that can directly and indirectly predict intention. PA refers to emotion regarding something that revealed a sense of pleasure (Pressman and Cohen. 2005) or the tendency to experience very pleasurable feelings. At the high pole, this factor is anchored by enthusiasm and excitement. NA refers to feeling tense, remorseful, worried, or tending to have very unpleasant feelings. At the high pole, feelings such as anxiety and anger tend to be present (Cropanzano et al., 2003).

PP has its roots in the NAM (Schwartz, 1977). The theory is that MN will activate when PP occurs (Bamberg et al., 2007); it refers to the individual's awareness of conceivably detrimental consequences (Han, 2014) or the degree to which a person is aware of the harmful impacts of not acting altruistically with respect to the people or things one values (awareness of need). In other words, it relates to being aware that the absence of a specific behavior could have a negative impact on other people or things (De Groot and Steg, 2009). OE also comes from the norm-activation model (NAM) and refers to the extent to which a person believes he or she can reduce or solve (or control) a problem (Steg and De Groot, 2010).

On the second layer, there are four constructs that directly and jointly determine intention. This layer is the core of the framework and originates from two seminal theories, the TPB (theory of planned behavior) and the NAM (Norm Activation Model). The goal of this research is not to discuss in detail the different characteristics and dimensions of the TPB and the NAM, as this has been done in detail elsewhere (e.g. Fishbein and Ajzen, 1975; Schwartz, 1977; Ajzen, 1991); it is, however, necessary to carry out a brief analysis of the constructs.

The TPB is an important social cognitive model and one of the most extensively used models for investigating the relationship between people's attitudes and actions (Russell and Fielding, 2010). Its aim is to explore variance in volitional behavior (Ajzen, 1991). The original constructs of this theory consist of three internal factors, namely SN, attitude, and PBC. SN refers to the perceived social forces involved in people performing or not performing a special action (Ajzen, 1991). PBC means people's understanding of control or non-control—the ease or difficulty as well as the possibility or impossibility of carrying out a special action (Liao et al., 2007); attitude refers to the extent to which a person assesses a special action as desirable or undesirable (Fishbein and Ajzen, 1975). MN, the last variable in the second layer, is rooted in the psychologist Schwartz (1977) NAM of altruism, which assumed that environmentally sound behavior takes place as an extension of personal ethical norms. MN refers to “an individual's opinion that performing in a specific behavior is right or wrong” (Bamberg et al., 2007) or the individual's perception as to which action is right or wrong (Simsekoglu and Lajunen, 2008). Finally, the last (third) layer is willingness to adopt RE, which is directly affected by the variables on the second layer. Based on our model the study hypotheses were presented (Fig. 1).

3. Method

3.1. Participants

A cross-sectional survey was designed to gather data from farmers (livestock producers) in the Kohkiluyeh district in the Kohkiluyeh and Boyer Ahmad provinces of southern Iran as our interest population (N = 230). A representative sample (n = 140) was determined based on the sampling table (Krejcie and Morgan, 1970) and selected through simple random sampling of a list of farmers. The age range of our sample was from 22 to 76 with a mean of 45 years. (SD = 11.73). Most of the farmers were men (96.4) with a minority of women (3.6). This proportion is very common in the Iranian context, as agriculture and livestock breeding is considered “man's work” and a low ratio of females work in this population. The average length of experience in livestock breeding was about 11.37 years (SD = 7.46) and ranged from 1 to 40 years. Regarding educational level, while 4 farmers did not answer this question, most of the interviewees (76; 54.3%) had a university degree; the others included 35 graduated from high school (25%); 7 with middle school education 5%), 15 having finished primary education (10.7%) and 3 with no education (2.1%). Note that in Iran, there are five main levels of education: primary lasts 5 years, middle, 3 years, and high, 4 years: in total 12 years, plus the additional years taken to gain a college degree. In the sample group, the distance of the farm to the source of electricity was from 1 to 600 m (m), with a mean of 70 m (SD = 11.73). About half our sample have a second job besides livestock breeding. Eighty-nine farmers (63.6%) confirmed that they have access to finance and credit for their job while the remaining 49 (35%) said they had no access to finance and credit. Two farmers did not respond to this question. Respondents had the right to refuse the interview or to answer any question if they felt uncomfortable with it. If a farmer refused an interview, he was replaced by another. No payment was made to farmers. Interviewing time for completing the questionnaire was about 40–50 min.

3.2. Data collection techniques

A structured questionnaire (compiled by a researcher) was administered by face-to-face interviews of farmers in March 2017. Our research questionnaire was developed subsequent to an in-depth literature review process of previous studies regarding variables on research framework so that we were able to select items from prior research that closely followed the measurement of our own framework constructs (The references for each variable present in Table 1). The farmers in our sample were asked to denote the extent to which they agreed/disagreed with the statements presented by ranking each variable according to a 5-point scale (from very low = 1 to very high = 5). Table 1 presents items from the questionnaire. To evaluate the validity of the measure, we used a group of professionals from relevant disciplines, including RE, livestock science, agriculture extension, and environmental psychology. The Cronbach's alpha reliability coefficients were also used to test the reliability of different scales in the questionnaire through a pilot study conducted with 30 farmers from the main population, (however not from our final sample) which revealed a highly reliable level of internal consistency, generally 0.74 to 0.90 (Table 1).

Table 1
Constructs/variables and their measuring statements included into the questionnaire.

		References
Intention ($\alpha = 0.84$)	7 items	
I plan to use RE at my farm		Yazdanpanah et al., 2014a, b
I will try to use RE at my farm		
I would like discuss RE with other farmers		
I intend to encourage others to use RE on their farm		
Attitude ($\alpha = 0.75$)	3 items	
Using RE on my farm is of benefit to me		Yazdanpanah et al., 2014a, b; Bijani et al., 2017
Using RE at my farm is valuable for me		
Using RE at my farm is a wise choice		
MN ($\alpha = 0.81$)	3 items	
I feel (or would feel) a moral obligation to use RE at my farm		Yazdanpanah and Forouzani (2015)
I (would) feel good about the use of RE at my farm		
If I use RE at my farm, I feel I am making a personal contribution to something better		
SN ($\alpha = 0.84$)	4 items	
Most people who are important to me think that I should use RE at my farm		Yazdanpanah et al., 2016, 2011
Agriculture experts who are important to me think that using RE at my farm is desirable		
People in my life, whose opinions I value, would approve of my use of RE		
My family who are important to me think that the use of RE is desirable		
PA ($\alpha = 0.76$)	4 items	
To what extent does using RE in your farm evokes pride feelings to you		Pressman and Cohen. 2005
Joy		
Hope		
Satisfaction		
NA ($\alpha = 0.74$)	*4 items*	
Worries		Pressman and Cohen. 2005
Annoyance		
Aversion		
Stress		
PBC *($\alpha = 0.87$)*	4 items	
It is mostly up to me whether or not to use RE on my farm		Yazdanpanah et al., 2015d
I have enough skill and knowledge to use RE on my farm		
If I wanted to, I could easily use RE on my farm		
Using RE on my farm is difficult for me		
PC ($\alpha = 0.87$)	3 items	
I think the equipment cost of using RE is more expensive than for fossil fuels		Kim et al., 2014
I think the maintenance cost of using REs is more expensive than for fossil fuels		
It takes a considerable amount of effort and cost to use RES		
PR ($\alpha = 0.87$)	9 items	
Using REs here is not safe		Park and Ohm. 2014
RE can harm our society including animals and plants		
I am worried about the dangers of RE at my farm		
Using RE needs huge investment, which is risky		
Using RE would me require to begin a new habit, which is risky		
Using RE is time and cost-consuming for me, which is risky		
Due the lack of enough infrastructures, using RE is risky		
Due the lack of knowledge, using RE is risky		
OE ($\alpha = 0.76$)	3 items	
I am jointly responsible for the problems caused by using fossil fuels in cattle breeding		De Groot and Steg 2009; Yaghoubi et al., 2019
I believe I am co-responsible for the reduction of fossil fuel used in agriculture		
It is good to be using RE on our farm to prevent CC		
PB ($\alpha = 0.88$)	8 items	
RE gives us environmental benefits		Kim et al., 2014; Park and Ohm, 2014
RE will promote rural development		
RE gives us more economic and industrial benefits		
RE may help us develop increased industrial competitive advantages		
RE may lead to new and better ways to treat and solve social problems		
RE may lead to new job opportunity		
RE will increase our well-being		
Overall, I feel that using REs is beneficial for our society		
PP ($\alpha = 0.90$)	5	Items
I worry about problems caused by emissions of CO2 from fossil fuels		De Groot and Steg 2009
I think the environmental degradation due to CC is a serious danger for humans		
I think environmental degradation due to CC is a serious danger for coming generations.		
I think CC from using FF is a serious danger for the environment, nature, and animals.		

4. Results

4.1. Relationship between variables

To investigate the correlations between variables, we used the Pearson test (Table 2). The results showed that intention has a relationship with almost all variables and a particularly strong relationship with MN and PB. However, PR is not significantly correlated with intention (Table 2). Furthermore, Pearson test correlation between framework's variables and farmers' age revealed that only SN has a negative relationship with farmers' age ($r = -0.20$; $Sig = 0.02$). Subsequently, the differences/similarities

Table 2
Investigation of the correlations between variables (Pearson test).

	PP	PB	OE	PR	PC	PBC	NE	PE	SN	MN	Attitude	Intention
PP	1											
PB	.36**	1										
OE	.42**	.61**	1									
PR	.34**	.26**	.21**	1								
PC	.20*	.43**	.41**	.32**	1							
PBC	.11	.33**	.21*	.03	-.06	1						
NA	-.27**	-.42**	-.28**	-.06	-.17*	-.33**	1					
PA	.39**	.44**	.36**	.21*	.18*	.49**	-.48**	1				
SN	.16	.49**	.28**	.04	.20*	.33**	-.27**	.25**	1			
MN	.27**	.56**	.47**	.17*	.24**	.43**	-.49**	.38**	.26**	1		
Attitude	.23**	.47**	.25**	.21*	.27**	.41**	-.35**	.42**	.46**	.46**	1	
Intention	.19*	.52**	.33**	.16	.28**	.46**	-.42**	.46**	.29**	.64**	.50**	1

** 0.01 level; * 0.05 level

Problem perception (PP), perceived benefits (PB), outcome efficacy (OE), perceived risk (PR), perceived cost (PC), perceived behavior control (PBC), negative affect (NA), positive affect (PA), Subjective norm (SN) and moral norm (MN).

among the farmers regarding the framework's variables across education levels, was analyzed using analysis of variance (ANOVA). The results reveal that there is no significant difference between different farmers' education levels.

4.2. Main analysis

To test the research hypotheses, we conducted structural equation modeling (SEM) using AMOS 20. Based on Fig. 1, regarding the direct effect, the path relationships revealed (Table 3 and Fig. 2) that PA ($\beta = 0.38$, $p < 0.017$) and PB ($\beta = 0.39$, $p < 0.013$) are significant predictors of the attitude toward RE (H5 and H8 confirmed). These variables predicted about 51% of the variance in farmers' attitudes. Paths from other variables (NA, PR, and PC) to attitude were not significant (H6, H7, and H11 rejected). Furthermore, OE ($\beta = 0.41$, $p < 0.034$), PC ($\beta = -0.26$, $p < 0.034$), and PB ($\beta = 0.55$, $p < 0.0001$) are significant predictors of the MN toward RE (H9, H10, and H11 confirmed), being able to estimate 57% of the variance in farmers' MN. Other variables (PP and PR) do not have a significant effect on MN (H12 and H13 rejected). Finally, SEM revealed that PBC, attitude, and MN are significant predictors of farmers' intention (H1, H3, and H4 confirmed). These variables predicted about 80% of the variance in farmers' willingness. MN appears to contribute most to the model ($\beta = 0.54$, $p < 0.0001$), followed by attitude ($\beta = 0.32$, $p < 0.0001$), and PBC ($\beta = 0.17$, $p < 0.015$). Paths from SN to willingness were not significant (H2 rejected). Regarding indirect effect, our SEM analysis revealed (Table 3) that PE ($\beta = 0.12$), PB ($\beta = 0.48$), PC ($\beta = -0.14$), and OE ($\beta = 0.22$) have indirect effects on intention.

5. Discussion and conclusion

Iran is a major producer of GHG. Agriculture in general and the livestock sector in particular play a major role in GHG emissions, and farmers (livestock breeders) are the most important stakeholders in that regard. To our knowledge, however, no studies have been conducted in Iran to investigate the behavior of farmers with respect to mitigation practices, such as using RE on their farms, or their willingness to adopt such practices. Inspired by this research gap, the current study is pioneering research, carried out in Iran with the goal of investigating the intention of farmers with respect to using RE on their farm. As such, we expect the results of this paper to contribute to the growing literature on mitigation behavior and the acceptance of RE. To accomplish this goal, we used a comprehensive framework, based on a social–psychological model (Huijts et al., 2012) to examine the willingness of Iranian farmers to adopt RE. First, our results revealed that this framework could significantly increase the estimation of the variances in intention (80%). This conclusion is based on a study by Armitage and Conner (2001), who found that the average explained variance of intention, applying the TPB and the Theory of Reasoned Action, was about 39%. It is also based on other research in this domain in Iran. For example, Rezaei and Ghofranfarid (2018) found that an extended TPB can predict 46% of the variance in intention in a rural population in Iran. Furthermore, Yazdanpanah et al. (2015a; 2015b) found that HBM and extended TPB can predict 33 and 63%, respectively, of intention in a sample of students. Bakhtiyari et al. (2017) found that HBM can predict 46% of the variance in intention toward biofuel in a sample of agriculture experts. Komendantova et al. (2018) found that social cognitive theory can predict 59% of the variance in intention toward RE in a sample of

Table 3
Standardized direct, Indirect and Total Effects.

	PP	PB	OE	PR	PC	PBC	NE	PE	SN	MN	Attitude
Standardized total effects											
MN	-.08	.55	.41	.08	-.26						
Attitude		.38		.02	.008		-.02	.38			
Intention	-.048	.42	.22	.05	-.14	.17	-.008	.12	.10	.54	.32
Standardized direct effects											
MN	-.08	.55	.41	.08	-.26						
Attitude		.38		.02	.008		-.02	.38			
Intention						.17			.10	.54	.32
Standardized indirect effects											
Intention	-.04	.48	.22	.05	-.14		-.008	.12			

Problem perception (PP), perceived benefits (PB), outcome efficacy (OE), perceived risk (PR), perceived cost (PC), perceived behavior control (PBC), negative affect (NA), positive affect (PA), Subjective norm (SN) and moral norm (MN).

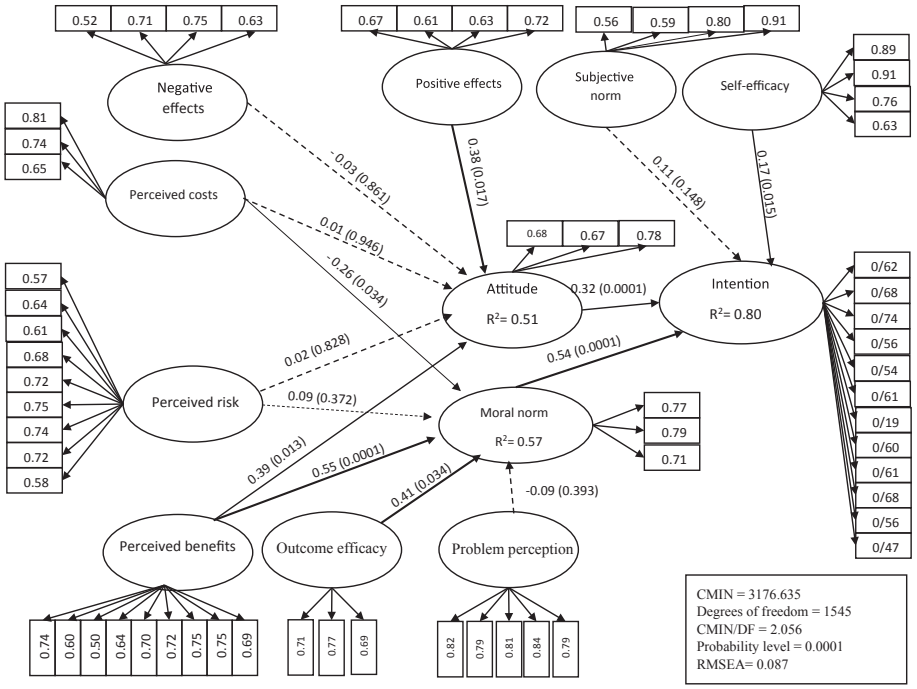

Fig. 2. Overall fit of the proposed model and path coefficients of the relationships.

Iranian student. In comparison with previous studies in Iran regarding acceptance of renewable energy, our result is satisfactory.

The result of our structural equation modeling revealed that PB is an important predictor of attitude and MN. PB refers to a person's beliefs about the relative advantages of a decision or action. In line with this finding, Kim et al. (2014) and Park and Ohm (2014) found that PB is a determinant of attitude. In the present study, PB refers to a farmer's belief in the perceived effectiveness of using RE on his/her farm. This finding can be interpreted as the fact that farmers' awareness of different advantages of RE in their professional life can shape their attitude and moral obligation regarding RE. For example, while Iranian farmers have suffered from the different negative impacts of CC (particularly drought, increasing temperature, and warm wind) (Hayati et al., 2010; Yazdanpanah et al., 2013b; d) and water scarcity (Yazdanpanah et al., 2013a, c; Salehi et al., 2018) in the country, they now think about how RE can reduce these kinds of disaster; they will be interested in other different benefits of RE and, of course, feel an obligation to use them. They realize that RE has different advantages for their personal and professional life and also for other people, society, and the environment. Thus, higher PB will probably lead to a favorable attitude and MN toward RE. From a practical point of view, these findings indicate that farmers' knowledge of RE, including an understanding of its impacts, can affect their perception of their benefits. Agriculture extension programs (Yazdanpanah and Feyzabad, 2017) are very important in this regard. Furthermore, as Park and Ohm (2014) have indicated, governments and markets need to encourage farmers to see the advantages of RE. PA has a strong effect on attitude. This finding was also confirmed by the results of Midden and Huijts (2009). In contrast to their study, ours showed NA to have no significant effect on attitude. Our study found PR to have no effect on attitude and MN; the Midden and Huijts (2009) research also found PR to have no effect on attitude. Our result revealed PP to have no effect on MN and OE and PC to have a strong effect on MN.

OE, one of the key variables in the NAM, is another predictor of MN. It refers to assessing the perceived usefulness of participating in a special behavior in order to prevent a threat. It is defined as the belief that a recommended coping response will be effective in terms of protecting oneself and others from a threat. According to Bandura (1977), it refers to the anticipation that the action will be effective in reducing the threat. OE relates to the effectiveness of a coping measure to reduce or avoid the existing risks (Floyd et al., 2000; Milne et al., 2000). In our research, it refers to the efficacy of using RE to solve different problems arising from the application of fossil fuels. Our finding was also confirmed by previous studies. For example, Cass et al. (2010) revealed that a positive assessment of the advantages of RE is the core determinant of support for RE development. From a practical point of view, agriculture extension programs should focus on the capacity of RE to solve the problems of farmers that are produced by fossil fuels. PC is another predictor of MN, but negatively. PC refers to a person's beliefs regarding the relative costs of adoption of RE. This finding suggests some policy implications for increasing farmers' MN toward RE. Policymakers should make an effort to reduce the cost of the components, processing, installation, and assembly of RE installations, which are too expensive for some farmers.

The SEM result regarding the second layers revealed that only SN has no significant effect on intention, while other variables (attitude, PBC, and MN) have a strong effect on intention. Previous studies in Iran in the domain of renewable energy also revealed that these variables have a significant effect on intention (Rezaei and Ghofranfarid, 2018). Regarding the absence of a significant effect of SN, many researchers (Trafimow and Finlay, 1996; Petrea, 2001; Lee et al., 1997) have remarked being under either attitudinal or normative control in a different range of behaviors is normal for individuals. In line with this finding, Bamberg and Moser (2007) revealed in their study that SN has no direct effect on intention. Regarding significant effects, MN was the strongest predictor of intention. Interestingly, in the study of Yazdanpanah et al. (2015b), with respect to social acceptance of RE among a group of students in Iran, MN was found to be the strongest predictor of intention in the presence of attitude, SN, and PBC. This finding was also confirmed by the study of Rezaei and Ghofranfarid (2018) of a rural

area in Iran. MN are internal moral rules or values motivated by anticipated self-administered rewards or punishments (Arvola et al., 2008). When experts realizes that the use of fossil fuel pose threats to other people, species of plants and animals, or the biosphere at large, and that actions they initiate could avert those consequences they will result to use RE which has minimal consequences. The existing studies (Arvola et al., 2008; Bissonnette and Contento, 2001) provided important results which are consistent with those found in this study and which imply that MN has a significant contribution to intention. According to the finding which showed that MN significantly predicts intention, this study suggests that the more a person feels his/her behavior is a personal norm to use biofuel the greater his/her intention to use biofuel. Our study shows that in the field of biofuel, it may be helpful to think positive, self-rewarding feelings in order to encourage individual to use it. This can be explained by the fact that in Iran, a main fossil fuel player in the world, use of RE constitutes a behavior that is more moral than rational. In other words, for farmers, although using fossil fuels on the farm is obviously cheaper than using RE, when they see their different negative impacts on humans, society, and the environment (Huijts et al., 2012) they feel an obligation to use renewables. From a policy implication view, our finding suggests that encouraging farmers to use RE on the farm may be a useful way of promoting them through MN tools and focus on positive, self-rewarding feelings about the application of RE. This finding has long been supported by different studies (Molin, 2005; Cass et al., 2010).

Attitude is another predictor of intention. The farmers' attitude, such as the degree to which he/she considers that supporting a RE will carry positive consequences, was the main cause of this/her willingness to use RE. Attitude has long been shown to effect behavioral intentions regarding conservation and resource consumption. The willingness to use RE is a type of conservation and consumption behavior and our result confirm these findings from the previous studies (Walker et al., 2010, 2014; Cacciatore et al., 2012). For example, in the case of willingness to use hydrogen technologies, Molin (2005) reached the same results about willingness to use RE. Or Cass et al. (2010) found that expectations and positive evaluation of benefits from RES is the main determinant of support for RE developments. Our finding also illustrated that as well as self-rewarding feelings about RE, farmers look at other benefits of RE. From a policy implication view, this finding suggests that to encourage farmers to use RE, policymakers should focus on understanding farmers' attitudes because, without a suitable and positive attitude toward this initiative, each and every target regarding social acceptance of RE and any initiative will probably fail. In line with previous research on RE (Yazdanpanah et al., 2015b, c; Bakhtiyari et al., 2017; DeWaters and Powers, 2011) and other environmentally friendly behavior (Azadi et al., 2018; Tabernero and Hernández, 2011; Bamberg and Möser, 2007; Meinhold and Malkus, 2005) PBC, in this research was the another predictor of intention. It refers to the extent to which performance of an activity or behavior is under individual volitional control or personal evaluation regarding the capability to act (Bandura, 1997). The transition to RE on the farm is not an easy task. It requires technological innovation, expense, knowledge, greater efforts, and changes in farmers' habits. In other words, it is more complex phenomenon than fossil fuel use. This finding suggests that policies seeking to encourage the application of RE on farms should be provided to ensure that farmers find them easy to accept. Furthermore, there may need to be a focus on the strategies that strengthen farmers' plans and objectives to accept the initiative. Supportive policy and extension work will encourage farmers to overcome difficulties and barriers to the use of renewable energy and ultimately lead to their acceptance of it.

6. Conclusion

Our results revealed that this framework could significantly increase the estimation of the variances in intention. Furthermore, our results revealed that PB is an important predictor of attitude and MN. PA has a strong effect on attitude and OE and PC to have a strong effect on MN. Furthermore, The SEM result revealed that only SN has no significant effect on intention, while other variables (attitude, PBC, and MN) have a strong effect on intention. The findings are expected to yield recommendations for public policy, as well as extension and education recommendations for stimulating successful adoption and mitigation behavior among Iranian farmers.

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